Stochastic projections for west coast rock lobster

S.J. Johnston and D.S. Butterworth

MARAM, University of Cape Town

Summary

This document presents stochastic projections for the west coast rock lobster resource for two variants of future recruitment.

WARNING: The results and conclusions in this document are PRELIMINARY; the calculations will need to be repeated using updated estimates of historical poaching levels, and hence may change.

Results are presented for stochastic west coast rock lobster projections assuming the following future (2019+) constant catches (as per the 2018 recommendations) are taken:

A12: 6 MT
A34: 29 MT
A56: 19 MT
A7: 29 MT
A8+: 161 MT TOTAL: 244 MT

Two possible variants with respect to future recruitments are explored:

Variant 1: Future recruitment values (i.e. R2015, R2020m R2025 and R2030) are drawn at random with replacement from the estimated R1970…R2007 parameter estimates (i.e. excluding R2010), where these values were estimated using the "2019 new assessment method".

Variant 2: 25% of the simulations are as described above. For 75% of the simulations, future recruitment values (i.e. R2015, R2025 and R2030) are drawn at random with replacement from the estimated R1970…R2001 parameters estimates (i.e. the R2004, R2007 and R2010 estimates are excluded). The motivation is that these last three estimates are less precisely determined in the model fitting.

For all super-areas, results are for the same σ_R=1.0 value, as motivated in Johnston and Butterworth (2019).

Results for median recovery in 2025 compared to 2006 are shown in Tables 1-6 for each super-area separately and then for the whole resource. Corresponding trajectory plots are shown in Figures 1-6; these shown both medians and 50% probability intervals for the

separate super-areas. A further variant is added for the whole resource which use Variant 2 for all super-areas, except for A7 for which Variant 1 is used; the rationale is that while generally variant 2 seems to be preferred, for A7 this leads to dropping the three lowest (and most recent) values in the series which may give a misleading impression of likely future behaviour.

Table 1: A8+.

MODEL	Median B75m(2025/2006)
Old model deterministic	0.873
Variant 1: New model stochastic σ_R=1.0 but don't sample R_2010	0.974
Variant 2: New model stochastic σ_R=1.0 but don't sample last three R estimates (2004, 2007 and 2010)	0.966

Table 2: A7.

MODEL	Median B75m(2025/2006)
Old model deterministic	0.930
Variant 1: New model stochastic σ_R=1.0 but don't sample R_2010	0.430
Variant 2: New model stochastic σ_R=1.0 but don't sample last three R estimates (2004, 2007 and 2010)	0.970

Table 3: A56.

MODEL	Median B75m(2025/2006)
Old model deterministic	2.698
Variant 1: New model stochastic σ_R=1.0 but don't sample R_2010	2.192
Variant 2: New model stochastic σ_R=1.0 but don't sample last three R estimates (2004, 2007 and 2010)	2.194

Table 4: A34.

MODEL	Median B75m(2025/2006)
Old model deterministic	0.948
Variant 1: New model stochastic σ_R=1.0 but don't sample R_2010	0.831
Variant 2: New model stochastic σ_R=1.0 but don't sample last three R estimates (2004, 2007 and 2010)	0.841

Table 5: A12.

MODEL	Median B75m(2025/2006)
Old model deterministic	1.600
Variant 1: New model stochastic σ_R=1.0 but don't sample R_2010	1.206
Variant 2: New model stochastic σ_R=1.0 but don't sample last three R estimates (2004, 2007 and 2010)	1.235

Table 6: Total biomass over all 5 super-areas. A further Variant 3 is added which uses Variant 2 for all super-areas except for super-area 7 for which Variant 1 is used (see text).

MODEL	Median B75m(2025/2006)
Old model deterministic	1.071
Variant 1: New model stochastic σ_R=1.0 but don't sample R_2010	0.913
Variant 2: New model stochastic σ_R=1.0 but don't sample last three R estimates (2004, 2007 and 2010)	1.053
Variant 3: Variant 2 for all super-area except for super-area 7 for which Variant 1 is used.	0.914

Reference

Johnston, S.J. and Butterworth, D.S. 2019. Comparison between methods of estimating historical and future recruitment for the west coast rock lobster super-areas. FISHERIES/2019/AUG/SWG-WCRL/15.

Figure 1: A8+ median biomass (B75m) trajectories of B75+/B75+(2006) with 50% probability envelopes for either Variant 1 or 2 for future recruitment sampling.

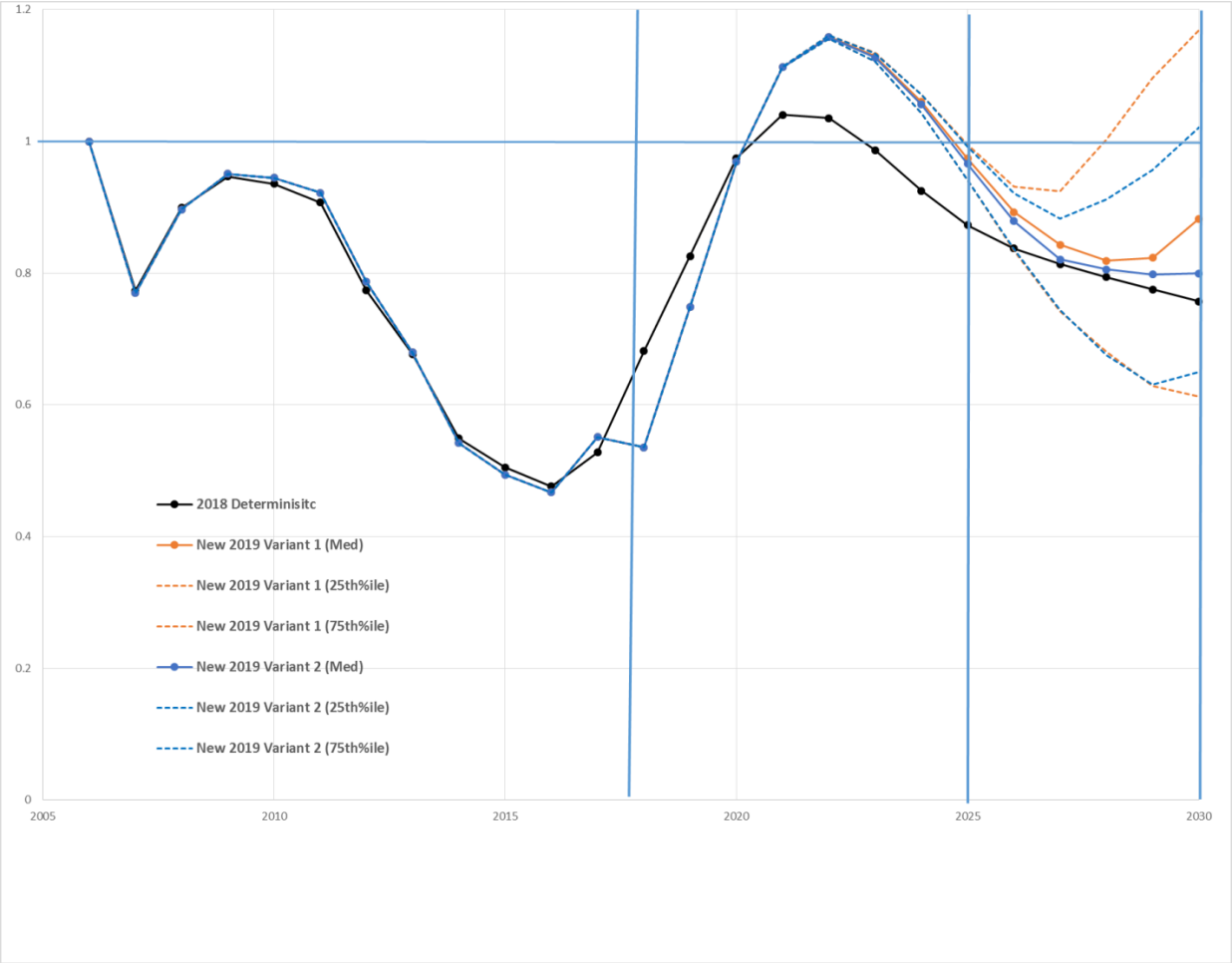

Figure 2: A7 median trajectories of B75m/B75m(2006) with 50% probability envelopes for either Variant 1 or 2 for future recruitment sampling. Note that these are for the assessment option that upweighted the trap CPUE data for a better fit to the more recent values.

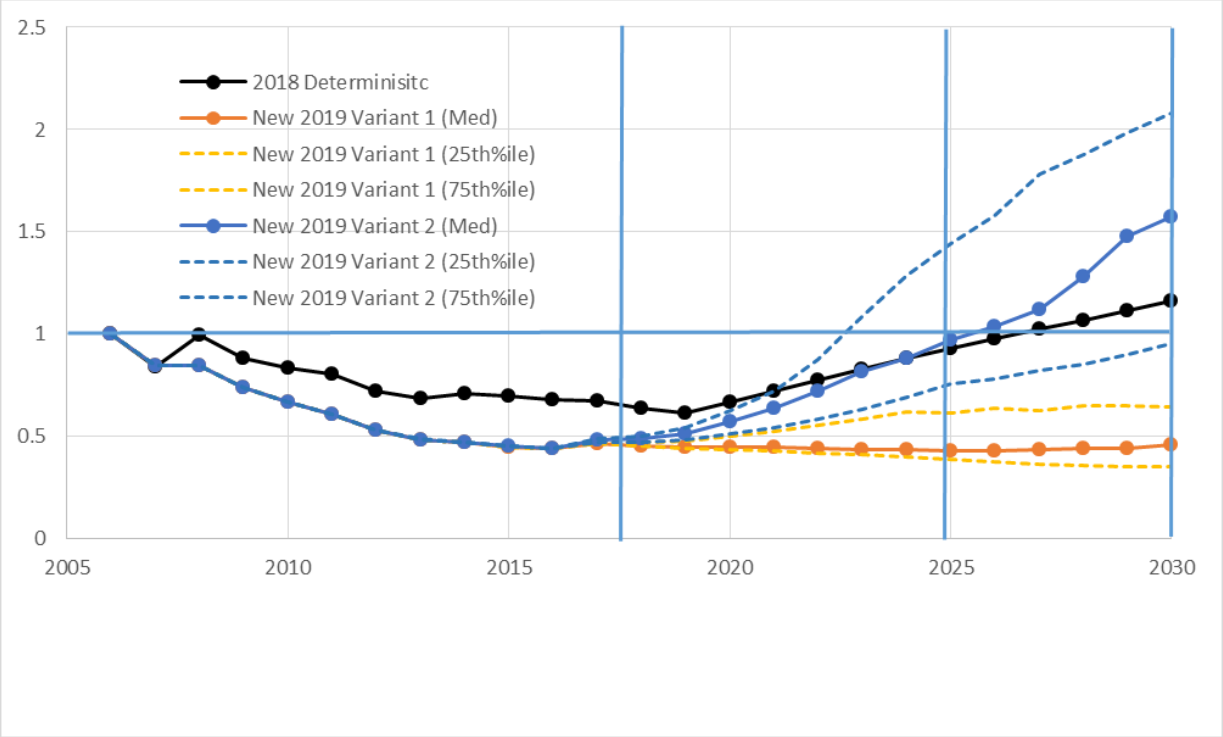

Figure 3: A56 median trajectories of B75m/B75m(2006) with 50% probability envelopes for either Variant 1 or 2 for future recruitment sampling.

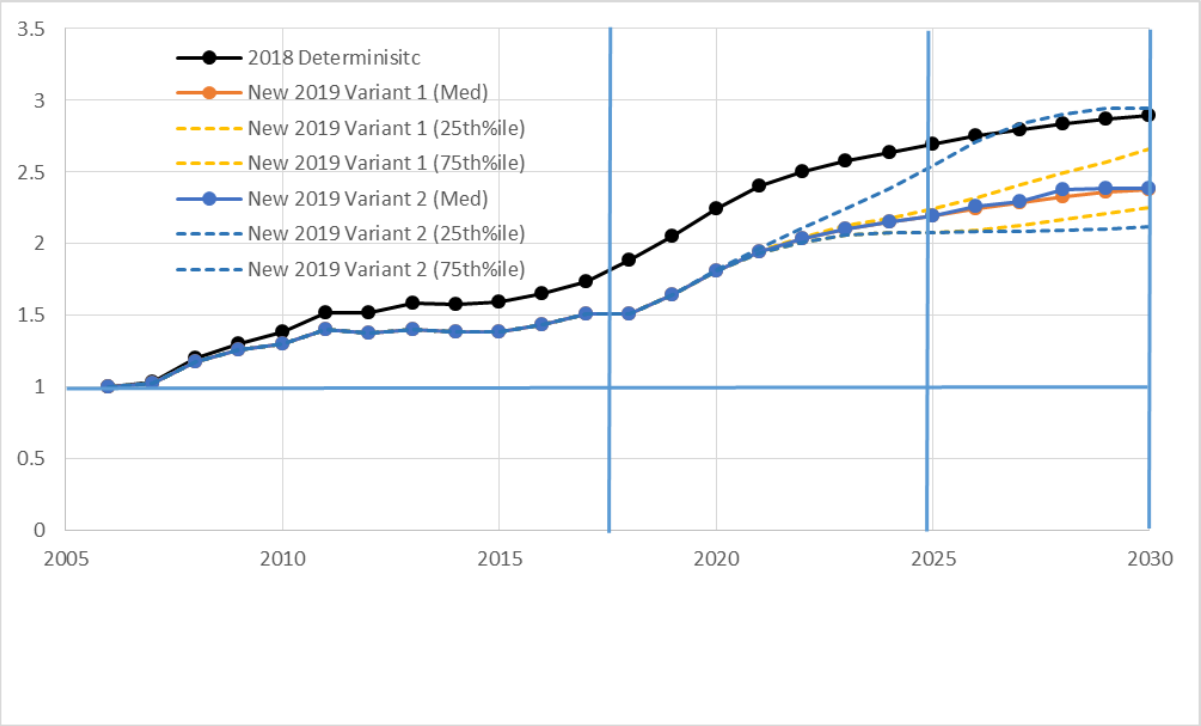

Figure 4: A34 median trajectories of B75m/B75m(2006) with 50% probability envelopes for either Variant 1 or 2 for future recruitment sampling.

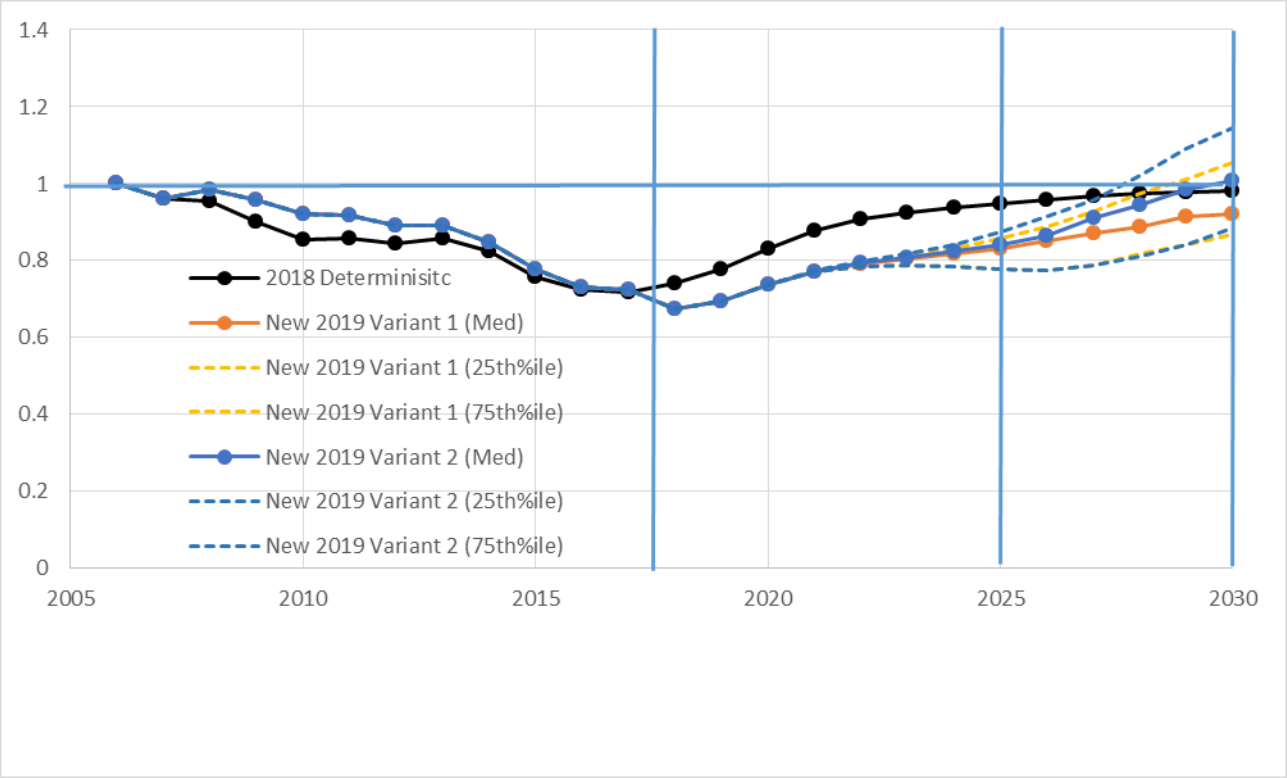

Figure 5: A12 median trajectories of B75m/B75m(2006) with 50% probability envelopes for either Variant 1 or 2 for future recruitment sampling.

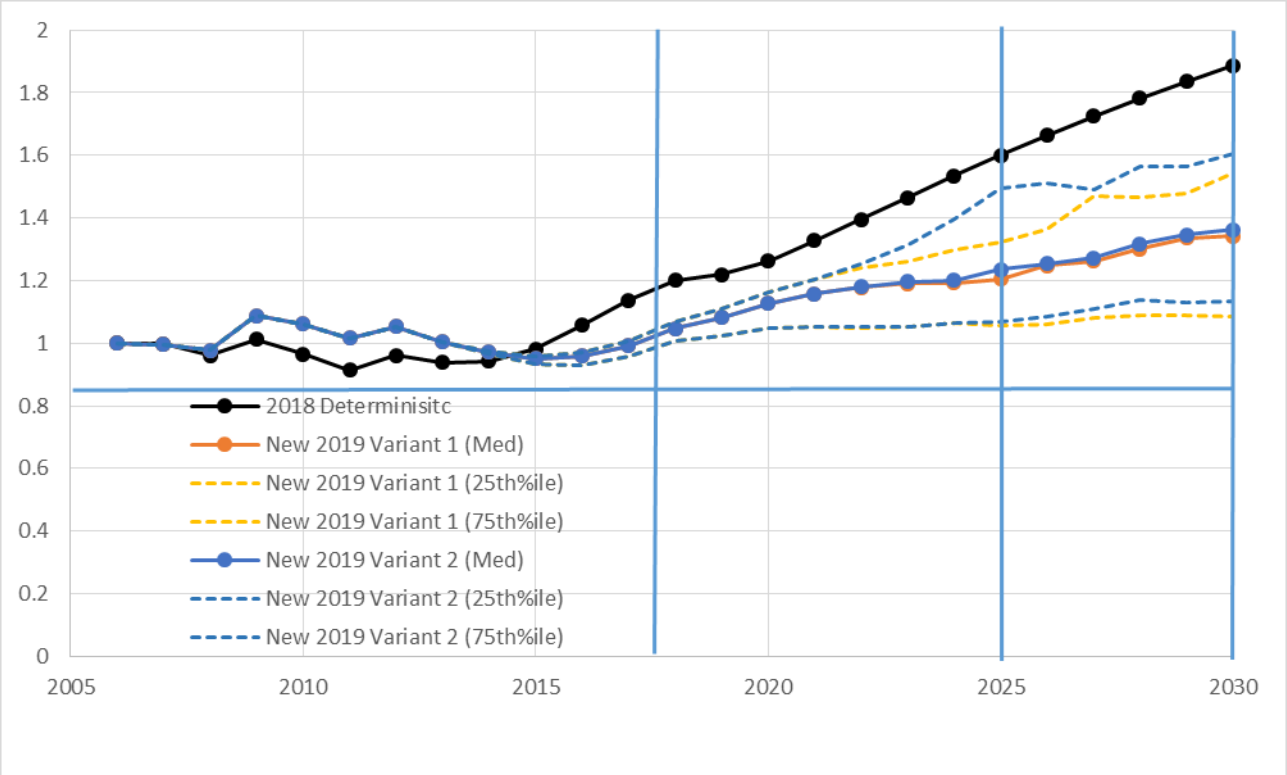

Figure 6: Total median biomass trajectories for future recruitment sampling based on either Variant 1 or Variant 2. A further Variant 3 is added which uses Variant 2 for all super-areas except for super-area 7 for which Variant 1 is used (see text).